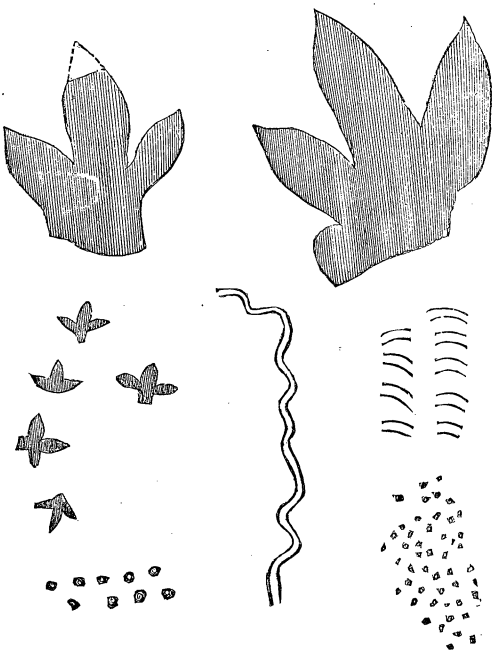
sions, the most striking of which are shown in the wood-cut, suggesting tracks.



Tracks and markings on Triassic sandstone at Weehawken, N. J.

Ripple marks and rain fossæ on other slabs help vividly to recall a shore upon which these ancient waters of the Triassic basin washed, laving the forms of amphibious reptiles or pouring over crawling Crustacea, while showers beat upon the imprinted sands; and on shelving and shallow bars the ripples sculptured their counterparts in gentle furrows.

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RESEMBLANCES IN ARTS WIDELY SEPARATED.[1]

BY OTIS T. MASON.

FROM the times of the earliest travelers down to the present day, we have narratives of the occurrence of the same inventions (implements), practices, modes of speech, institutions, theories, and religious creeds and cults in regions wide apart.

The older historians and ethnologists were wont to say that

[1] Read before the Washington Philosophical Society, Jan. 30, 1886.

similarity of human actions argued consanguinity in those who practiced them, that when the same phenomena occurred in two places they must have had their origin from the same race. Those who hold such theories are not all dead, as any one conversant with recent literature well knows. It is quite possible also that among older thinkers there were other ways of accounting for such similarities as I have mentioned.

Before speaking of another explanation it is necessary first to examine more closely the old doctrine. Admitting that all like inventions had their origin from the same race, we have two possible ways by which each one may have been planted in different parts of the world. An art may be so peculiar to a people that its presence argues their presence always, in which case the art may be said to have the same inventor and executor. An art may originate with a race or people, some of whom may carry the knowledge of it everywhere, or foreigners visiting that people may learn the art and carry it home, or it may, undesignedly on the part of any one, be diffused.

In our day of illustrated books and papers there is no telling how far the tuition of culture may extend. In this second case the art has the same inventor, but not necessarily the same executor or disseminator.

Which of these two causes has been active in any case seems to me to be a matter of counting—of numbers. The same race of people would hardly move about over the world, plant themselves here and there, and forget all the occupations and customs of fatherland excepting one or two. Mr. Tylor told the Anthropological Society of Washington that he found in the neighborhood of Philadelphia so much old-fashionedness belonging to England that he could almost imagine himself in the midst of an English village of the last century. On the other hand, the occurrence of a fac-simile of a Grecian temple, as Girard College, in Philadelphia, where other examples of Greek culture are difficult to be found, is an evidence in favor of Hellenic influence, at least upon the architect and trustees of that building.

The other motive to the adoption of the same means for the gratification of human wants or the exercise of human ingenuity, of which previous mention was made, is the identity of those wants and the instrumentalities of their gratification in all branches of the human family, including both the natural apti-

tudes of man himself and the material environment out of which come the resources of gratification. Upon the principle that like causes produce like effects, it is nowadays argued that men will everywhere, under the same *stress* and with the same *resources*, make the same invention. We must carefully note that different grades of civilization and different ages of the world give variable significance to the words *stress* and *resources*. In each age and in each grade, natural, primeval aptitudes are intensified and warped by inheritance and tuition. Material environment is varied and intensified by ever accumulating historical information, refinement and science. Resemblances, therefore, by independent invention become rarer, as the circles of national and racial influence enlarge and cross one another.

Before attemptling to lay down rules by which like human activities may be referred to one or another of the causes just named, the activities themselves ought to be closely scrutinized, in order that we may arrive at an intelligent definition of the word *resemblance*.

Aristotle enumerates four sorts of causes of actions: The material cause, *ex qua aliquid fit;* the formal cause, *per quam;* the efficient cause, *à quâ;* the final cause, *propter quam*. With this classification as a basis we may regard human activities and the things associated with them from several points of view, as one example will shew. The Indian basket-maker there is plying her craft. She is the efficient cause of her art. Under other social organizations it would be the men, and in higher civilization it would be one of a small guild or trade, called the basket-weavers' union.

By her side are strips of grass, splints of root or osier, bundles of cane or rattan, either dyed or in the natural color. These are the material cause of her basket.

She holds in her hand a bone, or ivory, or wooden awl or pricker; it may be also that a knife, rubbing stone and paint-brushes are at her side. These and whatever other tools she uses constitute the instrumental cause of her work.

In her mind are certain forms of baskets and of basket-weaving related to her tribal art and to the structure of the vessel; others also arise spontaneously, and the resultant of them all is the formal cause of the work.

She has her peculiar way of putting her work together, of sit-

ting, of framing, stitching, plaiting, weaving, of placing her material into form for a fixed purpose. These constitute her manner of action, which we may call her processional or methodical cause.

Finally, the foregoing causes have been set in motion with a view to function, to the uses whereunto this basket is to be put—in a word, to the final cause. Moreover, to her art belong a technical vocabulary, all sorts of lore and myths, and even social organization and sometimes religion are influenced by it.

Now, what is true of one occupation is true of another. Each one of them, from the lowest to the highest, involves: 1, agent; 2, material; 3, implement; 4, form; 5, process; 6, motive or function; not to include others unnecessary to mention now.

Again, it must not be forgotten that the materials, implements, forms, etc., of most activities, excepting the rudest, are the products of other activities, and each may have had its six elementary causes, giving rise to generations and genealogies of causes.

Now, let it be especially noted that in each invention or art the resemblance may extend to only one of the six elements, or it may include two or more. Furthermore, resemblance may manifest itself only in some one generation in the genealogy.

If we read carefully the works of those who are constantly pointing out evidences of the migration of tribes or races, we shall see that their attention has been fixed upon only one or two elements of the art under scrutiny.

The complication of causes in producing a result stands in the same relation to the result that complexity of organization does to plants and animals. Those arts that involve the fewest causes, the shortest concatenations of causes, have the greatest chance of arising independently; while those that involve the greatest number of complicated and connected causes give the strongest evidence of absolute identity of origin.

Another consideration which we must not omit in this study is the natural relation between things and their uses; between the number of things which may perform a given function, between the number of functions which a given thing may perform. In human trades, languages, the organizations of society, the fine arts, moralities, the progress of learning, creeds and cults—the bonds of union between the ends to be attained and the number of possible ways of attaining each end vary immensely in

strength and number. Admitted that all human arts whatever start from natural objects, endowments and relations, it follows that in their pristine condition men took the causes of their activity immediately from nature—flint flakes for knives; sharp sticks for spears and spades; gourds and conchs for music; ejaculations for words; consanguinity for social bond; animism for theology, and dreams for revelation. These are so natural and necessary that we need not be astonished to find men flying to them in emergencies and inventing over and over again all the devices and methods of the primeval world. If a stone knife has functions peculiar to itself, if cutting is dependent on stone knives, then the stone knife will often be invented independently. If almost any vocal combination will recall an idea; if almost any vocal combination may stand for innumerable objects, then the possibilities of associating any object with a particular vocal combination will be feebler, and similarities in language in different localities will be more likely to arise from the same people, either by migration or by literary influence. But words fly with such ease and rapidity over the earth that we are in quite as great a dilemma regarding them, whether we shall say that those who use them are of the same blood, or whether in one case they are evidence of tuition.

Since we are thus almost always the sport of three rival theories, I would prefer to adopt a new plan. Laying aside predilections I would adopt the inductive method. There must be a great many resemblances in things from different times and places about which there exists positive information.

Resemblance by independent invention being the least probable, I would scrutinize with great care such examples to ascertain the degree of complexity in the things invented, which we are allowed to suppose. It is my pleasure to bring before the society two inventions about whose independence of origin there can be no question. One is a type of basket-weaving found only at Cape Flattery, in Washington Territory, and on the Congo. The other is the throwing-stick, occurring only in Australia, Brazil and Eskimo land.

The basket weaving may be called the bird-cage type, that is, a series of horizontal rods is crossed either at right angles or diagonally by another series of vertical rods, just like the wires in a bird cage. These rods are firmly lashed in place by a continu-

ous coil of grass or splint, making a diagonal stitch in the front and a vertical stitch in the rear. Now this process is common enough in wattling fences, fish traps, etc., but only in these two areas did men and women hit upon the notion that this stitch would make the most beautiful and effective close weaving. Wherein is the similarity in the two areas? The two forms of weaving stand thus: Alike in method or technique; different in agent (women at Cape Flattery, men on the Congo), in form, material and function.

The throwing-stick is a device for launching a dart or harpoon too heavy for a bow or in situations where a bow would be inconvenient. The Australians have no bows; the Eskimo uses his throwing-stick in the kyak, where a bow would be inconvenient, furthermore his missiles are far too heavy for a bow. Wherein do these inventions resemble? In agent, material, form and function; but not perfectly. In form they agree only in the fundamental invention, a handle and a peg or hook to catch the end of the dart or harpoon. The Australian and the Puru Puru stranded on this, their minds never conceived that it could be altered or improved. The Eskimo, on the other hand, has developed a dozen species of throwing sticks, so distinct that they can be separated by types, as follows:

The Greenland type.....Hooks on the harpoon shaft.
The Ungava type.....Fiddle head at the hook.
The Baffin type.....Broad and clumsy for bird spear.
The Anderson river type..Exceedingly primitive, all in one piece.
The Pt. Barrow type.....Amphora-shaped.
The Asiatic type.....Primeval in form.
The Kotzebue type.....Razor-strap form, central index cavity.
The Cape Nome type.....Pegged on the side, rude.
The Norton sound type...Climax of detail.
The Nunivak type.....Finger pegs replace cavities.
The Bristol (variety) .....A variety of Nunivah, but ruder.
The Aleut type.....Flat and wanting in detail.
The Sitkan type .....Elaborately carved.

These types are explained and illustrated in a paper about to appear in the first annual report of the National Museum.

If any one, therefore, questioned the relationship of the peoples now using this weapon, he would be allowed to compare only that of the Asiatic Eskimo, with that of the Australians. If he would regard the genealogies of causes which had led up to the simpler forms in the two regions, there would be no ground left for him to stand upon, and the case of independent invention would be clearly made out.